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Chronicle of a Scientific Expedition to Little Known Islands of Hawaii.
Lava Rock and Coral Sand*
By Alexander Wetmore.

Life on small islands, particularly in Pacific seas, has
always had attraction and many of ~~us~~ have dreamed of lengthy travels
^{the} amid coral sands and volcanic cliffs, ^{of tropical lands. A few are fortunate and} without gratification of our
^{accomplish such desires; others may find solace in a venture second hand} ~~desires.~~ Let us look for a time at the more interesting results of
a scientific cruise in the north central Pacific.

When the United States annexed Hawaii, in addition to the
eight large inhabited islands that form the territory as the tourist
sees it, we acquired a chain of ^{islets} ~~tiny spots~~ of rock and sand that
extend from the main group toward the northwest over a space of
1,300 miles. Uninhabited by man, except for a cable station at Midway,
these have been little known, as they are seldom visited. In 1909,
through the interest of former President Roosevelt, these Leeward
Islands of the Hawaiian group were set aside as the Hawaiian Bird
Reservation, and placed under control of the Biological Survey, U. S.
Department of Agriculture.

At intervals during years past parties have visited Laysan, an
important bird rockery, to study its wonderful bird life and perhaps
en route have landed for a few hours at one or two other points. On
the whole, however, the group from a scientific standpoint has been

unexplored. Early in 1923 arrangement was made with the Navy Department for transportation and other assistance, and a cooperative expedition was organized by the Biological Survey and the Bishop Museum, of Honolulu for a complete scientific exploration of the islands in question. On April 4 a party of twelve left Honolulu on a thousand ton Naval mine sweeper, the U. S. S. Tanager, with whose aid, travel among the outer islands continued until the middle of August.

Definite plans had been made for the prosecution of as many lines of scientific work as practicable. Workers in our party included a botanist, an entomologist, a geologist, a conchologist, an ornithologist, one or more to collect fishes, miscellaneous marine animals and plants, men occupied with studies of ruins left by man, a topographer to make maps and one or two general assistants. All were armed with cameras, while in addition, an expert in motion and still photography of birds accompanied the party to Laysan Island. The present writer as representative of the Biological Survey had charge and direction of the work of the scientific party.

In addition to our efforts the officers of the Tanager under Lieut.-Commander S. W. King and Commanding Officer Stephen Ingham made many observations of positions and soundings and secured much additional data for the correction of existing charts. Seasonal changes in weather made it expedient to work the farther islands early in spring and shifted our program so that no regular itinerary was pursued. In the present narrative to avoid confusion the various rocks and atolls are taken up in geographical sequence beginning with those nearest to Honolulu.

An impregnable stronghold.

The Island of Nihoa distant 270 miles from Honolulu on three sides presents dark cliffs of volcanic rock that rise 300 to 900 feet from the water. On the southeast is Adams Bay, a small indentation from whose low cliffs the land slopes steeply upward until it meets the sheer precipices that bound Nihoa on the north; the land appears set on edge with no level ground.

We came to Nihoa once during May and lay three days in the lee of the western cliffs without being able to effect a landing as southeasterly winds drove the surf directly into Adams Bay. On a return early in June we were more fortunate as the steady trade winds had swung to the northeast, leaving the middle bight of the bay in a scanty lee. A tiny sandy beach in the western end seemed to offer a suitable landing, but prudent observation proved it impossible as at irregular intervals huge breakers came crashing ^{onto it} in threatening destruction to small boats. In the middle bight we found a projecting rock which it was possible to approach with caution. With a careful eye on the waves in the distance, the steersman worked our surf boat in until as it poised for an instant, two or three feet away from the rock, the first members of our party jumped ashore, when with a "stern all hard" the boat backed away to safety, instantly, ^{advancing} ~~often~~ with a scant margin between it and a crashing breaker.

The ship lay at anchor a half mile off shore and landing of men, food and our scientific equipment began apace. The boats rose and fell on the rough water until in some slight lull they edged in to allow a bundle or box to be tossed to a man braced on the landing rock. Another crouched in a depression behind to receive the packages and pass them to others waiting ^{beyond,} ~~behind~~ until finally they reached safety on the rock shelves above. At irregular intervals huge rollers swept our shelving ledge where we hung like limpets or clung to a life line to prevent being swept away.

Darkness came shortly after six and the ship played her strong searchlight on the hard working shore party, one moment blinding us with a glare of light and the next leaving us in utter darkness as the roll of the ship threw the beam above us. Our water supply in heavy water breakers was cast overboard from the boats and dragged ashore by means of ropes. Boxes of canned goods were landed in like manner. Sugar and flour were both wet as usual in difficult landings, but salt water does not seem to injure them. The waves crashed constantly against the rock ledges ^{while} ~~above~~ which rang the shout of the lookout, warning of an approaching roller. Once the whale boat was caught unawares and swept bodily ashore over what an instant before had been an expanse of bare rock. I crouched at the landing rock with the water churning about my waist, watching with a sickening sensation as in some miraculous way the boat was washed back again way to safety.

At nine o'clock, with food and water ashore, the surf had increased until I refused further materials. We lashed our supplies for safety in various crannies and carried our cots and bedding to a little cave, the only available ~~spot for a~~ camp as the steep slopes offered on level spots for tents. With this strenuous work completed we lay for a few moments on our cots before falling asleep. The lights of the ship tossed a short distance offshore, while sixty feet below us came the steady crash and jar of huge seas on the rock ledges. The beam of the searchlight, kept on for a time to assist us in arranging our supplies, rose and fell, now illuminating the wonderful green and white of the foaming water and now the white or dark breasts of terns, boobies, and other sea birds whose screaming hosts filled the air.

The following morning after landing a few more essentials the Tanager continued west to Necker, with part of the party leaving us to our rocky island.

Though rough and inhospitable to the voyager, when once ashore Nihoa, in spite of its ruggedness proved of the greatest interest. Polynesians had once formed a colony of several hundred persons here. Level house platforms made of flattened stones rose one above the other in a little valley that during ~~the~~ rains evidently contained water. One or two of these paepaes contained upright stones marking heiaus or temples. The steep slopes now clothed with bushes had been terraced with great labor to permit the cultivation of sweet potatoes or dry land taro. A cave or two showed signs of ancient occupancy. In our excursions over the steep slopes we found a number of stone bowls fashioned from porous volcanic rock.

Nihoa thus was well known to the ancient Hawaiians and ^{it is said} legend-
ran that there were regular voyages made to it by canoe from Kauai
and Niihau. On the triangular summit of Miller's Peak, 900 feet above
the sea, we found a rocky cairn, floored in part with coral, that seemed
to have been made for a watch tower and perhaps for a light house to
guide distant canoes to an inhospitable haven. The peak was visible
in clear weather for a radius of over 40 miles.

Legend runs that in ancient times a fisherman ^{living on Nihoa} ~~here~~ had a beautiful
daughter who was desired by a Prince of Kauai, who came to claim her.
On informing the father of his intention he was told to consult the girl
in the matter. She ran up the steep cliff paths, the Prince in pursuit,
until she came to the ragged border of the pali (cliff) high above. "If
you touch me, I shall jump ~~over~~" she screamed, but the Prince, unable to
control his ardor, stretched out his hand to seize her. Instantly she
sprang to her destruction, while the Prince was turned to a leaning
stone. The stone still stands on the brink of the precipice where it
may be viewed by those who doubt the story.

Small groves of a slender palm grew in some of the gulches, while
a scrubby woody-stemmed plant allied to our common lambs quarter clothed
the slopes. In these were flocks of the saucy Nihoa ~~Finch~~, (not a true
finch but a strong-billed member of the curious Hawaiian family Drepanidae)
and an occasional ~~Miller-bird~~ ^{a form} (new to science), both species restricted
in range to this barren rock and found nowhere else in the world. Hordes
of terns nested on the slopes, boobies and frigate-birds formed colonies

in the bushes and the beautiful snow white love birds rested in pairs on tiny ledges on the huge black cliffs. Albatrosses, found elsewhere near the sea here nested on a flat 850 feet above the waves.

After six days the Tanager returned and landed a party who had been working on Necker, while we others were reembarked without incident except that a huge blind roller washed me off the landing rock when I was trying to talk with Commander King, so that I swam out to the surf boat to finish our conversation.

An island of mystery.

On November 4, 1786 the Frenchman La Perouse sighted a rough barren rock, west of the main Hawaiian group, which he named Necker Island in honor of the Swiss banker Jules Necker, who at the time was busy in France with a futile attempt to stabilize the uncertain exchequer of an uneasy government. Though the French Exploring Expedition remained in the vicinity for a brief time no attempt was made to land and the journal of La Perouse comments mainly on the barrenness of the place. The Island was visited on May 27, 1894, by Captain J. W. King, father of Lieut.-Commander King, who took possession of Necker for the Hawaiian government, and left a copper cylinder recording this fact. This cylinder was found by a member of our party and returned to Honolulu for preservation for its historical value.

From a distance Necker appears as a huge block of stone that with nearer approach is resolved into a long ridge of rock, cut in six jagged knolls that sweep in a semicircle to enclose a small bay. On a ^{distant} ~~near~~ view the island resembles some misshapen monstrous animal crouched at rest amid the waves. With the northeasterly or easterly trades blowing, we found a secure anchorage on the western side at the north end opposite a broad rock shelf at the base of the cliffs that afforded a landing place. The waves rose and fell here for twelve or fifteen feet, but at one point where the rock wall was smooth it was possible to lay a small boat broad side, where it ^{was} ~~could be~~ held free from danger by the strong back wash, while ^{and} ~~men~~ fended off with boat hooks. Though landing was simple, location of camp was difficult. The landing ledge was flooded during the highest tides, but we found a secure spot to tie the cook tent on a protected ledge 40 feet from the water. Rough ledges above partly protected by the overhang of the cliff, furnished smaller platforms where the members of the shore party distributed their cots and scientific apparatus as best they might. My own sleeping quarters were fully seventy feet above the water, and as a party we roosted at night like so many sparrows or pigeons on any sheltered projection. Never have I occupied a rougher spot for a camp.

As has been gathered from the preceding statements the island was ^{in the extreme} ~~very~~ [^] ~~ragged~~. The porous volcanic rock cut by dense intruded dikes of harder material was weathered until it was more or less decayed and frequently broke away in considerable masses under the weight of a man.

We moved about by climbing ^{over} ~~up~~ the cliffs to the gentler slopes above, choosing hand and footholds with care to avoid friable projections.

Plant life was scant as the slopes were so steep that little soil had accumulated and in consequence there were few insects. Spiders, however, were abundant. Red-footed boobies and frigate birds nested wherever there were low bushes, blue-faced boobies and two species of albatrosses occupied the gentler slopes, while noddies, sooty and gray-backed terns swarmed wherever there was the slightest foothold.

Nihoa, the island we had just left, was well known to the ancient Hawaiians, but Necker had no known native name nor does it figure in the many ancient stories and legends of that people. Though thus from all appearances unknown there are found on this isolated bit of rock, far below the horizon from distant Nihoa many signs of occupancy by ancient, more or less primitive man. Small shelter caves scattered over the faces of the sloping cliffs showed some signs of human occupancy as attested by occasional bits of stone bowls, a low retaining wall to level the floor, or the remains of a primitive fireplace. On one occasion we carried a screen to one of these slight caverns ^{eighty} ~~seventy~~ feet above the waves and on carefully sifting the earth in its floor recovered squid stones, other stone ^{tools} ~~toys~~, sharp-edged fragments of hard rock used perhaps in making bone fish hooks, some stone bowls, and ^{two or three} human leg bones charred by fire. These, though exciting the imagination became ordinary with

examination of a wonderful series of heiaus or stone temple platforms rectangular in form, ranging in size from a few feet to sixty feet in length by half as wide, ^{that} had been built on the ~~rugged~~ ^{ancient temples} higher points of the island. The floors of these ^{ancient temples} were smooth except where a raised platform two or three feet wide had been built across one of the long sides to a height of twelve or fifteen inches. At regular intervals along the back of this were erected roughly rectangular blocks of stone a foot or more wide by three or four feet high. These continued around one to three sides of the platform, more often on the side toward the open sea. Usually one block in the center was larger than the others, with smaller stones ranged on either side. At times two or more stones, one of them often water worn, apparently brought from a rough beach below, occupied the center of these ^{enclosure} ~~platforms~~.

That these man made platforms were ancient temples is attested by the discovery on the visit of Captain King of crude stone idols that lay prostrate, where they had fallen from the erect border stones. A number of these were destroyed by the mistaken christian zeal of a royal edict, but fortunately a few have been preserved in museums. Careful search by our party yielded only a fragment of one of human form, and a second in form of a fish (perhaps a shark). Others, of which there were probably many, had been taken as curios by men who have landed for casual inspection from time to time.

In all there are over forty temple platforms on Necker, most of them in excellent shape, though perhaps untended by careful hands for hundreds of years. One in particular that had its floor, paved with a mosaic of beach worn pebbles, brought with considerable labor from the distant water's edge, was as smooth as though made a year ago. The time and the cause for their making ^{of these structures} are mysteries as yet unsolved. Some have considered these heiaus as remnants of some ancient culture that flourished among the people of a fanciful Pacific continent. Facts, however, indicate otherwise since the implements from the lower caves, while slightly different from the stone tools of the historic Hawaiian are distinctively Polynesian in design, so that there is no need to conjure up some strange unknown race as the former inhabitants of our island. We may, however, speculate on the personality of the men long dead, who labored here to do honor through love or superstitious fear to unknown Deity. There is here no permanent water supply, nor are there food resources or sufficient space for the support of permanent population. Obviously then worshippers came here from a distance, perhaps from Nihoa perhaps from the formerly populous Napali cliffs of the island of Kauai. May we suppose that here flourished a worship of gods who guided the first Polynesians in their long ocean journey from the south to Hawaii? A cult established in the remote period of insular isolation before renewed intercourse with the south had added the God Kane to the ancient trinity of Ku, Lono and Kanaloa, an ancient religion followed in later years by a few initiates who kept alive here on this remote rock altar fires of a cult whose sacred name may have been Kapu, and so unknown to

the general populace? A religion whose rites were so fearsome or so holy to the devotees as to preclude their celebration in public or their mention in story so that with the decadence of the older people all knowledge of their form or place has disappeared?

Such ponderings ^{are} appear especially appropriate as one reclines at dusk on a cot perched on a rocky ledge high above the sea, with the wash and crash of waves as a background for a mosaic of sounds, formed by the yelping of terns, the croaking of circling boobies, and the soft barking notes of gentle petrels among the rock crevices near one's head. Or when, as one awakens when the first rays of dawn touch the clouds at the horizon, untold thousands of terns, as if at a preconcerted signal rush out from the rocks in a vast cloud to greet approaching day. In the cold light of mid-day the stone temples of Necker present a problem whose mysteries still remain to be solved. It is strange that neither here nor on Nihoa were we successful in discovering ancient human burials whose bones might aid in telling who the ancient visitors to the island may have been.

Islands of coral sand.

Like La Perouse after leaving Necker, we continued west until we sighted a pinnacle rock and a little later the line of breakers that guard the lagoon at French Frigates Shoal, a spot named by the famous French explorer in honor of his gallant ships, appellation suggested in all probability by the form of the rock, which has a crude resemblance to a ship under sail. With the Tanager at anchor in the calm water south of the reefs we crossed in the surf and whale boats to East Island to

establish a shore camp for the conchologist, ornithologist, ichthyologist, and some other members of the party, while a few whose work required less time for completion lived on board ship and landed each day to pursue their investigations.

At French Frigates Shoal
~~Here~~ thirteen islands of coral sand lie scattered over a long curving lagoon at distances varying from a mile or two to a few hundred yards apart. All ~~were~~ ^{are} low, rising only from 8 or 10 to fifteen feet above high tide mark, and all ~~had~~ ^{have} a monotonous sameness of appearance, with their ^{and} beaches of dazzling sand, and scanty vegetation. At this season with steady trade winds blowing a surf against the northern and eastern reefs, the lagoon itself was like a mill pond, and the ship at anchor in its lee rested as easily and quietly as though in some land-locked harbor. Though heads and banks of coral, some barely awash, filled broad areas in the lagoon, channels from one to five fathoms deep, led between, through which the heavy motor boat, a fair weather craft, traveled with an ease that the sailors sincerely appreciated after the somewhat strenuous work in pulling boats that had marked our landings during the more boisterous weather of spring. Though calm at this season these low islands were evidently swept in winter by heavy gales from the south and west, which cut and carved their soft, loose sands and made frequent changes in their outlines. East Island, on which our first camp was established, last June, was about two thousand feet long, but was shown on a chart made several years ago as a mile in extent. It had evidently been washed away recently. The islets on the whole were long and narrow, with curving outlines. Some, still in the process of formation were mere sand spits, while others had a few plant waifs stranded on their summits. A few only supported a growth of grass with odds and ends of herbs.

After a stay of a few days on East Island we loaded our camp gear in the motor boat, and with a small party, traveled west to another sand island several miles away, while the ship steamed slowly along to a new anchorage opposite. We wound about among the reefs to our new station, where we had some difficulty in landing because of an ebbing tide that left little water over an offshore line of coral. Finally the heavy motor boat grounded, but it was a simple matter to lighten her with men standing waist deep in the water and passing bundles from hand to hand ashore. By nightfall our tents were once more in line on a strip of open sand, with a huge colony of sooty terns, that chattered and cried at our intrusion, in the grass adjacent.

The days here in the main were cloudless except for transient showers of rain of a few minutes duration. The heat was tempered by the mild breath of the trades and, hardened as we were by exposure to weather, was not unpleasant.

The nights were wonderful with a full moon that made it a pleasure to recline on the warm sand, while tales of camps and field experiences in all parts of the world went the rounds. The finely ground coral and shell was washed so clean that it was a delight to dig in it with hands and bare feet as it brushed away, leaving no sediment of dirt whatever.

Small lagoon sharks ranging from five to eight feet long were abundant here and often came curiously about as we worked or swam in shallow water. Many were the tales told of them, but on the whole we paid little attention to these sharks, as Anderson from long experience in these seas, proclaimed them harmless. ^{and} All admitted that their fins cutting the water were repellant. ~~and~~ usually we bore knife, harpoon, or other weapon when we entered the water. It seemed at times ticklish business to wade ashore to some island from the launch, while the dark forms of sharks cut swiftly through the water near at hand attracted by the splashing of our movements.

Large rays, known here as "diamond fish" from their form, were also common but were very shy so that they disappeared at any evidence of human activity.

At our last camp, on Tern Island, we found some tools, dishes, a ship's compass, and other articles wrapped in a canvas and thrust under a log, while near at hand were stakes and refuse marking a Japanese camp of a few months past. Apparently the crew of a wrecked fishing vessel had sought refuge here until some other sampan had taken them away.

Boobies, shearwaters, and the other breeding birds of these low islands abounded and were our daily companions, as our tents were surrounded by their nests. One great blue-faced booby took our presence philosophically and accepted fish from the hand of George, our cook, as if it had been accustomed to such favors all its life. The sooty tern colonies found on a number of the islands were the greatest attraction, as in several a number of acres were covered by brooding birds, spaced at intervals of

one and one-half to two feet. Some had eggs, while in others the downy chicks had hatched and ran about peeping as we walked among them. Our visits to these were made when the sun was low, as otherwise the young die quickly from the intense heat when deprived of the shelter of their parents' wings. The eggs of these terns, one to a nest, laid in a bed of sand without nest lining, were wonderful in their variety of marking, as they varied from white to reddish brown in ground color, and from nearly plain to a surface boldly marked with splashes and blotches of dark brown or blackish. No two seemed alike and one might suppose that their great dissimilarity was an aid to the mother in picking her own nest from the multitude that surrounded it. By transferring eggs in adjoining nests it was easy, however, to demonstrate that a ^{sense} "bump" of locality brought the parent to her home, as a tern that had hovered a dark egg covered one that was nearly white, with apparent indifference to color, though its rightful egg lay in another nest a few inches away. During the fierce heat of midday the terns before returning to their homes wet their breast feathers in the lagoon and thus moistened the egg shell, a provision of instinct that reduced a temperature dangerous to the developing embryo, derived from the sun.

Strange and wonderfully colored fishes came to our nests and were duly deposited in tanks of alcohol. The collection of marine shells also prospered. Some, particularly certain species of cone-shells, came out only at night and were trailed by ^{themselves the conchologist through} their tracks in the sand, revealed by a water glass illuminated by an electric torch. The attraction of these

desolate bits of sand was more evident to the scientists than to the officers and crew of the Tanager, eager to make certain of a return to Honolulu in time to celebrate the fourth of July in port, and King and Ingham called me the "sand opihi" (opihī is the Hawaiian name for the limpet) for obstinately hanging on until the last possible moment to give time for ample collections of interesting specimens.

One day we went out to the rocky islet, which we named La Perouse rock, where we found the true "opihī" and other rock inhabitants of interest. This pinnacle rock is one hundred and fifty yards long by one hundred and fifty feet high, and may be scaled at the western end. We contented ourselves by landing on a rock ledge on the south that gave access to the southern face. The surf-boat swept along a low ledge in a gentle swell with men leaping ashore at every favorable opportunity and then backed off to stand by until we were ready to leave. Rock pools filled with salt water sheltered colonies of sea-anemones veritable gardens of living flowers rock inhabiting terns perched on the scant foothold of narrow ledges, ^{and} One specimen that we took fell from Schlemmer's hand ^{to be} ~~and was~~ torn to bits by a school of savage black trigger-fish as soon as it hit the water.

The volcanic rock was black in color, coriaceous in texture, and so ^{fr}iable as to make climbing dangerous. Light whitish or yellowish encrustations, seepage from the bird guano on the summit, in places formed heavy crusts or small stalactites. We imagined this lonely rock ^{to be} ~~as~~ the remnant of a larger island of volcanic origin and speculated on the length time that might elapse before it would finally be beaten into the sea by the ceaseless gnawing of the ever restless surf.

A lonely rock.

According to the Pilot Notes Gardiner Island is an inaccessible rock. If others had effected a landing there before our visit, there is apparently no record of the fact as we found no note of it either at the time or later.

About six o'clock one evening in late May, we passed a small sampan that had made a land fall on Gardiner Island and was now standing away for Maro and Dowsett Reefs. Our course was changed toward the smaller vessel in order to learn its name, and Japanese sailors on the little craft watched our approach silently, uncertain of our intention. When the name of the boat was made out to the satisfaction of our commanding officer we turned again to our course and as we fell away the fishermen shouted and waved in evident relief. The boat was the Taiyo Maru, a ^{tiny} fishing vessel out from the port of Honolulu, here six hundred miles from home and still headed westward.

Shortly after ^{this} Gardiner Island was sighted from the mast head, and at dusk the mass of the two rocks that form the island was dimly visible on the horizon. We came in slowly to anchor a mile to the south-west, when by the light of a small moon the summit of the rocks appeared white as snow from the excrement of its sea birds.

Though Gardiner had seemed far distant by the dim light of the moon at daybreak the following morning, it loomed near at hand, and many were our speculations as to the possibility of landing. After a hasty breakfast our party embarked in two boats and were soon in the lee of the island. The main rock only 200 yards long was composed of two peaks, the highest ^{rising} 170 feet ~~high~~ with a deep cleft between. A smaller rock was

separated by a narrow strip of water. At first sight the cliffs appeared steep and precipitous and in spite of the relatively calm sea a heavy swell washed the rocky base or surged in foaming crests that dashed against the steep walls. ^{that guarded the island} Near the base of the great cleft in the main island was a somewhat gentler slope than elsewhere, with two large rocks resting at right angles ^{to one another} as they rose straight walled without hidden projections from fairly deep water. On one there was a rock ledge a foot wide and three or four feet long. As the surges welled in the water rose almost to the ledge and then after two to five seconds pause receded quickly. At frequent intervals, ^{larger} heavier swells broke and dashed up over the higher rocks with a heavy wash. The surf-boat edged in slowly while King studied the possibilities of landing. Finally as we rose on a heavy swell we were allowed to drift in to the rock and Schlemmer in the bow leaped ashore. Instantly the order "stern all" was given and we backed away as the water fell. A minute later we came in again and I sprang to the ledge and ran up the rock as a heavier surge came in. In a few minutes eight men had landed and the boats then stood by while we followed out our investigations.

Once ashore progress was not difficult, as though the rock faces were steep they were eroded away to form narrow ledges that gave access to all parts of the island. The summit was gained without particular difficulty though ^{from a climb to the highest point} one projecting shoulder at the edge of a sixty foot cliff formed a fat man's peril over which we slid as we came down in spread eagle fashion feeling for precarious holds with hands and feet.

We found only a single species of plant, ^{on garden} a fleshy-leaved form restricted to a handful of individuals, though I saw a good many heavy spined seeds of a creeper (Tribulus cestoides) that grew commonly on low sand islands. These were in all probabblity brought here in the feet or plumage of the sea birds that had come from Laysan or French Frigates Shoal, ~~and~~ though here ^{sufficient} dropped on a barren rock without soil for their growth served to illustrate how such spiny plants are transported to lonely islands far at sea. Elsewhere, in the West Indies, I have seen lobes of cactus fastened to the feet of boobies in such a way that they might be carried from island to island.

Spiders, with large earwigs and a few other insects, were fairly common. Limpets and a few other shells clung to the rock, ^{in the wash of the surf} Birds were, however, the dominant feature of the life of the island. Terns of five species rested on the gentler slopes or the steep ledges indifferently. Tropic-birds nested in holes below the summit and the whole upper third of the island was given over to the blue-faced boobies, now on guard over their well grown young. These birds were as large as geese and it was necessary to drive or push the adults away ahead of us as when we passed them quietly they had a way of waddling up behind us and biting savagely with their heavy saw-edged bills, an attack that was often disturbing when one was picking a precarious path along some narrow ledge. Our way was marked by the raucous squalling of these great snow-white birds irate at being pushed aside with our heavy shoes.

Toward noon the surf rose and King recalled us before it became impossible to reembark.

An Ancient Bird Colony.

In traveling west from Gardiner Island, one comes soon to Maro and Dowsett Reefs - named from some ancient shipwreck^S - mere coral rings marked by breakers without visible land, and then over the horizon beyond the dangerous jaws of these hidden traps comes Laysan Island, distant 855 nautical miles from Honolulu. From its discovery Laysan has been famed for its seabirds. Pilot books and the logs of sea voyages through these waters describe their hordes and even the hydrographic charts depict the low elevation of Laysan with the air above filled with birds. Though small at best Laysan is the most pretentious of the islets in the Leeward Chain, as it is a mile and three-quarters long and a mile wide. An elevated rim rising somewhat abruptly from the beach line to a height of ^{twenty to} forty feet encloses a shallow oblong basin, in whose center is a saline lagoon with waters concentrated by evaporation under a blazing sun until they are far more heavily charged with salt than the sea itself. The sandy slopes leading down to this saltiest of salt lakes hold sweet water which falls in the frequent rains so that a supply fit to drink (though heavily charged with lime) may be obtained from shallow wells.

At an early day it was discovered that Laysan, or Moller as it was then known, held valuable deposits of guano, and for a period of years the island was of considerable commercial importance. A guano company established workings, ~~there~~, built buildings and maintained a considerable force of men. Small ships called by the dozen to carry away the harvest of nitrogen garnered from the sea through untold ages in living guise as the food of albatross, tern, booby, and shearwater and deposited as waste about their breeding places enriched by the bones and bodies of ^{countless} ~~untold~~ thousands of the birds dead from natural or violent causes in their crowded rookeries. Mixed with coral and shell sand the recent deposits are loose and earthy, while those of older periods have become hardened into a soft rock that is exposed in layers over the surface or is encountered in digging at shallow depths. In appearance this phosphate resembles sand stone but is in reality lime, as it is composed of guano and coral sand cemented firmly together. In its brownish masses one encounters frequent particles of egg shell or fragments of bone that attest clearly the manner of its formation.

The nineties of the last century marked the height of the guano industry, and from 1900 there was a gradual decline. The larger part of the deposits had then been exhausted and at the same time farmers in the states were being supplied with cheaper fertilizers from points near home. By 1908 shipments ceased and the island was practically deserted, leaving a number of frame buildings clustered about the landing, a few hundred yards of rails laid across the sand and three or four scattered piles of rock dug out for shipment and then deserted.

Through all these years Laysan had been literally covered by myriad sea-birds, but its bird life was not confined to these alone, as the grass and shrubbery that clothed the island harbored five species of land birds restricted to the narrow land expanse of this island (less than two square miles) and known in a native state nowhere else in the world. These included a tiny flightless rail, a species of duck, a warbler (family Sylviidae), known as the Miller-bird, and two species of a peculiar Hawaiian family (Drepanidae), one as large as a sparrow with strong robust bill known as the Laysan finch or "canary", and the other smaller with slender beak called from its coloration the "red-bird."

Laysan in addition is the metropolis of the Laysan albatross, a beautiful bird as large as a goose, with snowy breast, black wings, and delicately tinted bill. With it is found the sooty albatross, of equal size, but sober sooty gray plumage, the "gooney" familiar to tourists on trans-Pacific steamers.

For a part of each year these albatross frequent the high seas, true sea-farers who see no land even during periods of storm. About the first of November a part of them, those that are adult and feel the sexual urge, resort to remote, uninhabited islands where they gather in colonies as have their ancestors for thousands of generations for the purpose of rearing young. On Laysan their return each year was an event in the life of the guano workers, heralded with as much excitement as the arrival of some famous traveler in settled communities. The first to come were joined by others until in a comparatively few days the usual horde had gathered and mating and choice of nest sites was under way. Early

travelers who came to Laysan, with considerable exaggeration, placed the numbers of albatross in the millions, and in actuality their numbers ran to many thousands. Mated pairs of the Laysan species dotted the whole inner basin except where bushes prevented their nesting, while the sooty albatross colonized the barren sand beaches.

These great colonies, still in existence today, are the scene of intensely interesting activities. Mated pairs are ever attentive to one another and at the same time exhibit a lively interest in the doings of their neighbors. Man, as a comparative new comer, is still treated as an equal, and not as a being to be eyed with fear, and as we gaze albatross come walking up to examine us with curiosity, touching an outstretched hand with the bill as a token of friendliness and then, satisfied, strolling off about their own affairs, all with quiet dignity and an utter lack of fear. At the same time dozens of pairs near at hand or in the distance indulge in the famous albatross dance, a strange social custom that never ceases to attract and amuse the observer. Two birds approach one another and fence with clicking bills for a few seconds, then step about to one side, rise on tip toe and bow, suddenly raise one wing and preen the feathers beneath it, and then elevate the bill directly upward and emit a hollow groan. ^{Frequently} ~~At times~~ both performers act in unison; again one is out of time. Others eager to join wander up and a performer may finish with one partner only to begin immediately with another. This curious dance - we may term it the Laysan minuet - unlike the antics of most birds which are confined to courtship - continues through the entire period of incubation, and the rearing of the young. As the eggs are laid in November and December, hatch a month later, and the young remain under the parent's care until

May or June, the social activities of the adults continue for seven months or more. The dance of the black-footed albatross, given to the accompaniment of loud neighing calls is even more sprightly than that of their fairer cousins. Truly the life of these great birds will merit prolonged study by an observant animal psychologist.

The Marauders.

Unmolested for centuries on land the birds of Laysan knew their only enemies in the sea so that man on his arrival was accepted as a phenomenon of interest to be treated without fear. Aside from a certain amount of egging and the pulling of the long ornamental central tail spikes of the red-tailed Tropic-birds, the guano workers troubled the birds little except for the necessary infringement on their breeding areas by the guano workings. The year 1906 practically marked the close of the guano industry and though residence was maintained here for a few months longer, the island then was practically abandoned. On February 3, 1909 the entire Leeward chain with the exception of Midway (which is under jurisdiction of the Navy Department) was set aside by former President Theodore Roosevelt as the Hawaiian Bird Reservation. Though it would seem that this action furnished final protection to the harmless friendly hordes of sea birds that nested there, other forces were at work. Fashion still demanded feathers for feminine adornment, and this barbarian trade, blocked for the time within the limits of the United States, turned to more distant fields. Word came somehow to Honolulu that poachers were at work to the westward and in January, 1910 the revenue cutter Thetis, under Captain W. V. E. Jacobs, surprised and apprehended 23 Japanese on Laysan and nearby

Lisianski engaged in the killing of the harmless birds whose ^{interesting home} life we have just inspected. It is said that one lot of plumes had been sent to Japan. Yet officers of the Thetis estimated that wings and other feathers of more than a quarter of a million birds were stored in the old buildings on Laysan awaiting shipment. The vast rookeries had been decimated systematically by men armed with clubs. Hand cars and the old rail line left by the guano workers had been utilized to bring the spoils to camp for preparation and treatment and the ground about displayed the sad accompaniment of decaying carcasses and dead or starving young ^{as in} usual to plume hunting ^{operations} operations, among which wandered a few bewildered or crippled birds. Prompt action had, however, saved the rest of the bird colonies and free from further attack the albatross and tern were left to regain something of their former number.

What two rabbits may do.

With danger from plume hunters eliminated one might suppose that the bird colonies on this distant bit of American soil would flourish as in ages past. Further tribulation, however, was in store. Disturbances to the supersensitive adjustment of nature's forces through the coming or the temporary presence of civilized man are often strange and unexpected in their appearance and cumulative effects. As an instance we find on Laysan a tremendous damage wrought through the agency of ^{an animal that} what we might consider the most harmless and inoffensive of man's household friends, the domestic rabbit.

Sometime in 1902 the foreman of the guano works brought to Laysan three or four pairs of rabbits, partly to amuse his children and partly for the fresh meat that they would furnish. For a time the animals were kept about the houses more or less at freedom, but gradually a pair or two wandered farther away, attracted by broad tracts of grass, succulent herbage, and protecting shrubs. Rabbit enemies there were none, as cats and dogs were forbidden because of their damage to birds. Albatross must have gazed with tolerant curiosity at these lop-eared invaders with their curious hobbling gait, while no doubt many an irate shearwater hustled them with much strong language (if tone of voice is any criterion the wedge-tailed shearwater is a master of profanity) from the shelter of his nesting burrow. With abundant food and a genial climate increase was rapid, and in an incredibly short time rabbits became numerous. In the early years it was planned to kill them for the market, but for some reason this project was not put in execution. Until the close of the guano works, rabbits were kept more or less in check, but freed from man's influence, their ^{rate of} increase progressed by bounds. In 1911 their number was said to be astonishing and it was reported that they had killed some of the bushes. In 1913 the Biological Survey dispatched a party to Laysan, charged with the destruction of the rabbits before serious harm came to plant growth; several thousand were killed but the party of men withdrew before their work was complete. Laysan was kept in mind during succeeding years, but important matters intervened, the world war turned all eyes to Europe, and though Laysan was inhabited for a brief time in 1917 it was not until our visit in 1923 that we had definite word as to the outcome of conditions there.

Early accounts of Laysan Island and photographs taken twenty years ago depicted it as a pleasant spot that though without trees except for two or three palms was covered with green vegetation. There were extensive tracts of rank bunch grass, thick leaved shrubs made low thickets on the higher levels, somewhat saline flats near the lagoon ~~were covered~~ with dense mats of succulent stemmed herbs and in season flowering plants and vines lent a touch of color to the inner basin. Small birds sang or searched for insect food in the abundant vegetation and flightless rails in form like little chickens scuttled about with clacking calls at the borders of little openings.

Reports of damage ^{to} ~~of~~ shrubbery had led us to expect some changes but had not prepared our minds for the utter desolation that greeted Commander King and I, as we landed in the little harbor on Laysan early in April, 1923, and walked slowly up the sandy slopes to a point near the tumbledown buildings remaining from the guano workings. On every hand extended a barren waste of sand. Two coconut palms, a stunted hau tree and an ironwood or two planted by former inhabitants were the only bits of green that greeted the eye. Other vegetation seemed to have vanished, leaving not a trace of its former presence. The desolateness of the scene was such that we talked in undertones depressed in spirits by the utter change that had been accomplished. From all appearances ^{Laysan} ~~the island~~ might have been a section of some sandy desert with the gleaming lake below merely a deception of mirage. Without the restraining influence of active enemies rabbits had multiplied until they had absolutely stripped the island and then had slowly died away, starving in utter misery until of their vast army a few hundreds only remained. Careful inspection in remote corners

revealed a patch of tobacco, an escape from cultivation whose leaves had been gnawed by rabbits, but had proved too bitter to allay starvation; ^{and} a sickly mat of brown near the lagoon ^{that} marked a struggling half dead growth of sesuvium and pigweed, ^{and} ^Where the remaining rabbits had their stand. With other vegetation destroyed the number of rabbits was reduced to those that could eke out a precarious existence on the growth of these hardy plants. The rabbits could not increase and the plants were unable to mature their growth so that the two forces at work were about in equilibrium. Elsewhere shrubs denuded of bark standing or fallen to the ground marked the only sign of plant life.

We had come prepared to eliminate the rabbits, with one man in our party, expert in matters concerning control of injurious mammals, especially delegated for the task, and with camp established, the work began at once. The greater number of the animals were shot, the survivors killed by poison. The destruction of the majority was a simple matter, but the survivors became wary and it was necessary to hunt them out mercilessly one at a time. ^{The} procedure appears heartless perhaps but was of absolute necessity. Left unchecked the creatures might have eked out a precarious existence for a few years longer, but starvation in silent misery was the inevitable fate in store for them coupled with unending hardship or actual death for the multitude of other creatures associated with them. Further so long as rabbits remained on Laysan there was danger of their transport elsewhere, with resultant injury to other pleasant spots, of which more will be said later. Pursuit of them was therefore relentless so that none might remain to again increase the race in later years. During the thirty-six days for

which a base camp was established here their complete destruction was effected and for the last nine days of our residence no one saw a living rabbit. A party sent ^{to Laysan} ~~out~~ in May, 1924 reported no sign of them so that our effort was successful.

It is fortunate that the work had not been longer delayed. As the greater part of the rabbits (several hundred) were killed during the first five or six days ^{of our stay} the plant growth near the lagoon, relieved from depredation, responded amazingly and in two weeks time presented a luxuriant mat of green. Light rains fell and immediately little shoots of scattered green appeared from seed that still remained in the shifting sands, and some of the apparently lifeless shrubs put out a few leaves. To aid in this rejuvenation we planted quantities of seeds of plants and shrubs suited to growth in sand and even in the short length of time before our departure a slight change for the better was evident.

With the rabbits eliminated let us now examine the effect of their depredations on the bird-life of this island. A few dozen Laysan finches still sang their sprightly songs about the ~~tumbledown~~ buildings or hopped about among the rocks near the lagoon. Three individuals alone of the little red-bird remained on our arrival, but these perished during a three-day gale that enveloped everything in a cloud of swirling sand, but not until Dickey had immortalized one on his motion picture film. The ~~Miller~~-bird had disappeared entirely and of the Laysan rail but two remained. The duck (properly called the Laysan teal), never numerous in recent years as it was killed for food, had about held its own as twenty individuals were present, a scant foothold on existence for its species and it may be wiped out at any time.

The albatross though reduced in number are still present by thousands, and with them are many boobies, frigate birds and hosts of shearwaters and terns. The white-breasted and Tristram's petrels small sea birds ^{species} that appear mainly at night, were the only sea-birds that appeared to have suffered but they had almost disappeared; drifting sand, no longer restrained by vegetation, had buried them alive in their earthen burrows dug for hiding places against the light of day, or to conceal their nests. Let us hope for happier days when with vegetation renewed these birds may repopulate their former territory from colonies on nearby islands.

Lisianski.

The island of Lisianski, one hundred and twenty miles west of Laysan was named in 1806 by the Russian explorer Urey Lisianski, while en route through these waters on a course from Sitka to Canton. For two or three days his seamen had noted flying birds and other signs of land and one evening without warning his ship grounded on a coral reef. After two days severe labor she was salvaged and Lisianski went ashore on the island within the reef which he described as covered with creepers and other vegetation, but a desolate place whose soil was undermined by the burrows of a dovelike bird, with a mournful moaning note (unquestionably the wedge-tailed shearwater).

We sighted Lisianski through an early morning haze but came in slowly over uncertain shoals to an anchorage so that it was afternoon before we made a landing.

In form Lisianski resembles a parallelogram a nautical mile long by slightly less than a mile wide. A low ridge 40 feet high on the north-east marks the highest point, while the central portion of the island forms a low basin bounded by a rim that protects it from the ocean. In an early stage this basin was in all probability a lagoon like that at Laysan that has been filled until it no longer contains water, except after heavy rains.

An easy landing was made on a sandy beach that sloped so gently that it was necessary to establish camp 175 yards inland to insure safety from possible storm waves. With tents in place and camp arranged for work we had opportunity before dark to look about in spite of a drizzling rain that began to fall almost before we had perishable articles under shelter.

Never have I seen a more utterly desolate spot. Rabbits, brought here from Laysan by misguided persons who thought to leave a food supply for possible castaways from shipwrecks, had completely stripped the island of its vegetation and then had died a passive death by starvation. Their bleached and weathered bones lying at intervals where wind had blown them free from drifting sands were the only indications of the subtle instruments of destruction that had played such havoc with natural conditions on this isolated spot.

A few roots of grass and of pigweed had grown sufficiently deep to escape the incessant search of the starving four-legged pests and with the final disappearance of the mammals had begun a battle against the forces of wind and sand to cover the island. In several years (to judge by the apparent age of the rabbit bones) vegetation had extended scantily over ^{in a long line} ₁

an area of three acres ~~in a long line~~ near the northern end. Scattered plants of pigweed occurred elsewhere but at considerable intervals. Insect life had practically disappeared and land shells, abundant on most of these islands were extinct. Thaanum, the conchologist, was fortunate in discovering their dead shells embedded in humus that had formed under and around lumps of long dead coral. A species of rat had been reported as abundant here but had also been exterminated; no specimens of it had been preserved for science. Perching birds had never been recorded here but the fauna of the island in its primitive condition is only imperfectly known.

Bird life naturally focussed about the little area of grass and here were small colonies of gray-backed and sooty terns, boobies, frigate-birds, and a few petrels, whose nests and general activities were another involuntary check to the spread of vegetation. Albatross were scattered over the flats but were only fairly common. In fact the only abundant bird was the wedge-tailed shearwater whose nesting burrows undermined the soil in every direction so that one broke through into them every ten steps in traversing the island; a simple walk across the flats was thus filled with hazards for the uninitiated, but most of us soon became accustomed to stumbling among these hidden pitfalls and were able to view with considerable amusement the breakneck progress of casual visitors from the ship. Pairs and groups of the shearwaters rested on the sand in every direction and at dusk a host of others came in from the sea to spend the night in hole digging, fighting and general deviltry, ^{Activities} Accompanied by wailing moaning calls that near at hand suggested so many alley cats making a night of it but that at a distance merged into a blended volume

of sound that resembled the bleating of a band of sheep in the distance. It is this no doubt that has given shearwaters of this group the name of "mutton-bird" in Australian waters.

The small number of birds here, aside from the shearwaters, is to be attributed without doubt to the activity of plumage hunters who worked here perhaps to better advantage than on Laysan. Ruins of some old sheds near the center of the island of Japanese origin, marked the former site of their camps. As Lisianski is out of the usual path of the few ships that pass through these waters, poachers ^{may have} ~~unquestionably~~ worked here for a long time without discovery.

A view of the life of the surrounding sea offered a welcome contrast to the somewhat dismal aspect of the land. We were struck in particular by the large number of sea turtles that were present. Shallow coves along the beaches were filled with luxuriant growths of algae, submerged fields of green kept in constant motion by passing waves. Amid these plants browsed dozens of turtles ~~working slowly about~~ at intervals thrusting their heads up for air and then descending to continue their feeding. When satisfied they crawled clumsily out on the sloping sands to lie in peaceful sleep. On one occasion I counted 80, from fifteen inches to four feet long, in walking a distance of 300 yards along the beach. Others feeding a few yards off shore were hidden by ripples on the water and so escaped this casual census. Their only enemies seemed to be sharks; occasionally I saw one with one flipper torn away, with the bones of the upper limb exposed. We killed a number for food and found one filled with eggs nearly ready to be deposited.

Pearl and Hermes Reef.

Directly to the northwest of Laysan, distant 255 nautical miles, is the atoll known as Pearl and Hermes Reef named from two ships, the Pearl and the Hermes that, traveling separately, chanced to strike and founder here on the same night, an event that will live long in the memory of every sailor man. On charts of these dangerous shoals, available in 1923, was shown a curving line of coral ten or twelve miles long, open to entrance only on the north, but in a cruise along the southern margin the Tanager discovered several openings that gave easy access to the small islands inside. There were five of these in all, three along the south near the boundary reef, and two more toward the center. All were small, of irregular form and low elevation so that in heavy gales they must be swept by the sea. At most they rise only fifteen to eighteen feet above high water mark, and in many places are lower. They are composed of the usual coral sand built up on a foundation of limestone with heavy growths of bunch grass and a few other plants on their summits. As these islands are small in extent and on the whole little different from others we did not land camping parties on them but worked from the ship coming ashore each day.

Southeast Island, the most extensive of the lot, was reached after a mildly exciting passage through the surf in a break in the reef. On landing we found the usual colonies of breeding albatross, terns, boobies, and shearwaters, the first mentioned with well grown young as woolly as so many lambs. At one side was the site of a camp three or four years old and beside it a cairn of stones marking the grave of a Japanese, but with no indication as to why these people had come here. Apparently they had

traveled by way of Laysan for they had left behind a few rabbits now increased to a flourishing colony whose presence was wholly unexpected. The circumstance is a clear illustration of the danger of a rabbit colony such as had existed on Laysan, as the animals will surely be spread, from island to island by the thoughtless until these small spots of land one by one are laid waste. On this first visit I shot rabbits until I was out of shells and two days later inaugurated a rabbit drive ^{that} ~~and~~ combed the island thoroughly. Subsequently the "Tanager" returned on a second trip and the island was covered again, when we were forced to leave the matter for the time. On a reconnaissance in May, 1924 three rabbits were discovered here, of which two were killed. It is hoped the remaining individual may die of enforced loneliness! The island as yet had not been injured as vegetation was still abundant, but the increase of another year would unquestionably have caused serious damage.

On another day we penetrated to a second island of small size and then, drifting rapidly before the wind, continued to a third of like type. All of these as well as Southeast Island were tenanted by the Hawaiian Monk Seal, representative of a genus of tropical haunt whose three species are found respectively in the Mediterranean, the western part of the Gulf of Mexico, and the Leeward Islands in Hawaii. It is reported that in 1859 the "Gambia" returned to Honolulu, with skins and oil from 1,500 of these aquatic mammals killed in a cruise to the westward, but of recent years they have remained extremely rare. Though reported by many the species was unknown to science until 1905, when it was named from a single skull. Skins were first brought to the U. S. National Museum in 1913, so that our

observations on habits and the specimens that we secured form a decided contribution to knowledge. A considerable number lived in this atoll and more were found at Ocean Island. From these colonies stragglers spread occasionally to Laysan, Lisianski, and Midway. The monk seal, ~~is~~ a hair seal so that ^{with a} ~~its~~ pelt was formerly valuable only for leather, Like many other similar species ~~it~~ is now reduced to a point where it has no commercial status as a single sealing expedition could easily exterminate it. It is fortunate that the remnants of its race are confined to this great bird reservation where we may hope to preserve an interesting animal for future generations.

Adult seals were from seven to nine feet long, with bodies covered ^{thickly} with short, ^{stiff} ~~thick~~ hair. They fed on fish and when satisfied crawled out on the beaches to rest and sleep. It was common to find them forty or fifty yards from the water, sometimes surrounded by groups of young albatross, or lying alone amid clumps of grass. The seals seemed friendly harmless creatures that opened their great soft eyes to look at me and then often closed them again with a long sign to continue their slumbers. Others more interested rolled about with queer whining calls, unable to make me out. Only mothers with new born pups, as black as ink, or occasional bulls offered any offense and their movements were so slow and clumsy that their awkward rushes were easily avoided. Unlike many other species where each bull guards a harem during the breeding period, the monk seals seem to divide into pairs and to feed and sleep thus in company.

The weather was cold and stormy during our work here and we were frequently glad to don jacket life preservers for the warmth that they afforded, and the heat of small fires built on the beach to boil coffee (which we drank from large sea shells in default of cups) was at times grateful.

Life at a Cable Station.

The atoll known as the Midway Islands, usually abbreviated to "Midway," held by the Navy Department, is now under lease to the Commercial Pacific Cable Company and is operated as a relay station on the cable between Guam and Honolulu. Here reside twelve or fifteen whites, who operate the station and an equal number of orientals who act as servants, in touch with the world only through the long line of cable that reaches both east and west, except at intervals of three months when a supply boat brings mail and stores from Honolulu. At the time of our first visit we were received with great delight as the cable boat had been out of Commission, and on April 15 we brought the station the first mail received since January. A week later we returned to spend three days ashore, where we were most hospitably received by the Superintendent Mr. E. Desnouvee, Mr. W. S. Fraser, his assistant, and other members of the staff.

The lagoon at this atoll contains two main islands, Sand Island, on which is located the cable station and Eastern Island, a mile or more distant. Each of these is perhaps a mile long and rises well above the reach of the highest seas.

The cable company has worked steadily to improve conditions on what originally was a desolate spot of glaring sand and scattered bushes. The main buildings, four in number, are of steel and concrete arranged at the corners of a little plaza. Earth, brought in sacks from Honolulu covers the barren sand near the buildings and nourishes pleasant lawns with clumps of ornamental shrubs and flowers. The whole is surrounded by a heavy protective wind break of iron wood, or casuarina, trees, between whose trunks one may catch glimpses of the clear green waters of the lagoon. Tree lined walks lead to the wharf and to a vegetable garden where corn, peas, potatoes, beans, lettuce, tomatoes, and similar vegetables thrive with abundant weeds imported with the garden earth. A few sheep and a cow or two, with high windmills in the background, give a suggestion of some Argentine estancia, an illusion that is dispelled by a few minutes walk that takes one to the bleak wind-swept sands outside this artificial human paradise.

Eastern Island is uninhabited except by myriad birds and 18 or 20 donkeys, progeny of a pair imported 20 years ago from Honolulu and released here when they were no longer required for work animals. They ^{donkeys} find abundant forage and for water paw shallow pits a few feet from the water's edge from which they obtain a brackish seep that is not too salt for their needs.

Sand Island has the unique distinction of a thriving colony of domestic canaries which live at freedom in the shrubbery and in the mild and pleasant climate have increased from a few pairs to several hundred individuals.

The Laysan Finch has also been naturalized here and with it the little flightless rail from Laysan, both now found on Sand and Eastern Islands in abundance. A morning awakening in a comfortable room at the cable station with a cheerful chorus of song from canaries and finches offered a pleasant contrast to the ^amatutinal salutation from a multitude of shearwaters heard through the canvas walls of a tent whipping in the steady trade winds.

On Midway, ~~as well~~ as on all the other islands visited we encountered other travelers, clad in feathers, engaged in far more venturesome journeys than our own. Golden plover, turnstones, bristle-thighed curlew, tattlers, and sanderlings all pass south across the ocean to winter in distant islands through the entire broad stretch of the Pacific and in spring again return north to their far distant breeding grounds. At Pearl and Hermes reef I saw turnstones come beating up from the south at daybreak, evidently tired as they took shelter from the wind in the troughs of the waves, eager to gain the land again. The nearest land from which they ^{may have} ~~had~~ come was Johnston Island or the more distant Gilbert group hundreds of miles away, and other hundreds of miles separated these tiny bodies from the nearest ^{point} ~~lands~~ in Alaska, their distant goal. Though many must be lost enough come through to maintain the number of their species. The lawns at Midway seemed as welcome to turnstone and golden plover as to ourselves, and no doubt they were ^{equally} glad of an opportunity to rest under such pleasant circumstances.

^{End}
The Extremity of the Hawaiian Chain.

Though barely over the horizon from Midway, Ocean Island, the most northwesterly point in the leeward chain is seen more seldom than any of the other atolls or islands in the entire group. On older maps other islands marked as Patrocinio, Morell or Byer are usually shown farther to the westward but modern surveys have shown that these are non-existent. Ocean Island at present consists of an irregular circle of coral four miles or so in diameter with a small semicircular island known as Green Island, 1,800 yards long by 300 yards wide at its eastern side. One or two sand spits, bare of vegetation, lie on either hand. The island is only 25 feet above the sea at its highest point, and is so low that the atoll is a considerable menace to navigation in these waters. The surrounding reef has been the end of a number of ships and most of our knowledge of Green Island has come from those shipwrecked there or from ships that have stopped there for a brief space to search for castaways. As early as 1838 we find record of the loss of the gledstanes, while nearly fifty years later came the Dunottar Castle. Col. James H. Boyd, in charge of the party that rescued the crew of the latter ship, took possession of the island, which was christened Moku Papapa, for the Hawaiian government on September 20, 1886.

Perhaps the most celebrated shipwrecks at Ocean was that of the U. S. S. Saginaw, under Lieut.-Commander Montgomery Sicard, ^{a ship} engaged in 1870 in deepening the channel into the lagoon at Midway. Late in October, with this work completed, the Saginaw set out for San Francisco. On reaching the open sea the commanding officer announced his intention of proceeding to Ocean Island, to verify its position and to examine it for possible shipwrecked sailors. A course was laid supposed to bring them to this island at daybreak, but at three in the morning, with only brief warning, the ship ran ashore on the reef and by dawn the Saginaw had been pounded in two by the surf, so that a part had sunk. The ship had struck near Green Island, which proved a haven of refuge to the crew who remained here from the end of October, 1870 until the first part of January, 1871, living in part on the scanty stores saved from the ship, but mainly dependent on the seals and sea birds that made this island their homes. These natural resources were carefully husbanded, useless killing was prohibited and care was taken not to disturb these harmless creatures unnecessarily. In the meanwhile five men in the ship's gig, a well built whale boat which had been carefully decked over had made the perilous journey to Hanalei, Kauai, where they were wrecked as they attempted to land in the surf, and four of their number drowned; the survivor, William Halford, brought news of the plight of the Saginaw and a ship was dispatched from Honolulu at once to rescue her crew. The ship's gig, which made the long ^{and perilous} journey from Ocean Island may be seen by the curious in the Naval Museum at Annapolis.

Mindful of the fate of the Saginaw, we left Midway shortly after daybreak one morning, and at ten were in sight of Ocean Island. It may be noted here that careful observations made by Lieut.-Commander King, located the atoll a number of miles east of its charted position, while a current seemed to hasten our approach to it. It is these factors undoubtedly that explain part of the shipwrecks here including that of the Saginaw.

The atoll at Ocean has a broad opening^{gap} at the southwest partly open to the weather, ^{where} with heavy surf breaking^s on two points of reef nearly a mile apart. We were somewhat puzzled by smaller breakers in the channels between, but these proved to be due to isolated coral heads. After a judicious study of the situation Commander King and I went over in the surf boat to prospect the channel. Though the passage, wholly unknown to us, appeared somewhat dubious it was passed without great difficulty and we found ourselves in the quiet water of the great lagoon with Green Island nearly four miles away. The afternoon was passing but we made a hasty crossing to it, located a camp site and then returned to the ship. On the following morning I landed with four men and a suitable outfit.

So far as I know the island had not been visited by other naturalists so that our explorations were made with the keenest anticipation and delight.

A shelving beach of coral and shell sand fifty to eighty feet wide extended entirely around the island. Inland were series of low sand dunes grown with a peculiar shrub, sometimes known as beach magnolia (Scaevola lobelia), with broad oval leaves arranged in whorls like those of a rhododendron. In sheltered hollows this formed dense thickets, but on the slopes was whipped and beaten to a straggling growth by severe winds. In the center of the island in shelter of the dunes were irregular openings grown with grass and creepers. At one spot on the beach was part of an old boiler that we supposed may have formed part of the equipment at the camp established fifty years before by the crew of the Saginaw. We found no other trace of habitation though huts had been built here and trees planted at various times in the past.

Ocean Island like Pearl and Hermes Reef was a stronghold of the monk seal that hauled and bred unmolested on the beaches. Albatross were common and the open inland meadows were honeycombed with myriad petrel and shearwater burrows so that at every few steps we fell in to our knees through the roofs of these hidden pitfalls. The inner meadows were death traps for many Laysan albatross that dropped in here casually deceived by the apparent security and protection from wind. A few seemed able to rise on the wing without difficulty. Others in running to gain the momentum necessary for flight tripped on long vines and creepers fell head long. Discouraged by successive occurrences of this sort they walked about until weakened and then finally died of starvation. In the meanwhile they served as decoys that toled down others of their kind. Thus we interpreted the evidence of dozens of bodies and an equal number of albatross still alive, but on the verge of starvation.

The petrel colonies, though during the day apparently uninhabited at dusk were the scene of great activity. As the sun sank shearwaters appeared and swung about ^{il} ~~in lazy turns~~; at dusk they were joined by white-breasted petrels that quartered in swifter courses until when it was really dark the air was filled with these nocturnal creatures that during the day had remained hidden in their burrows. Shearwaters almost brushed my face with their wings and as the petrels passed I caught the faint musky odor that clings persistently to their feathers.

Imagine a small bit of sand in the midst of a great ocean, with strange sea birds circling about, attracted by the beam of light from a strong electric torch, or pursuing one another with snarling cries, heedless of our presence. What scene could be more strange or more alluring?

Among other creatures we found here multitudes of rats, about one-fourth the size of our gray rat and related to the native Hawaiian rat, formerly so abundant that it was hunted by Hawaiian princes with the bow and arrow but now extinct except for a little colony on Popoia Island, off the north shore of Oahu. These rats, ^{on Ocean Island} long-tailed, brown-haired, heedless creatures, appeared at dusk in swarms so that by morning the sand was laced with their tracks. They belong to a group whose forms are widely scattered in the Pacific, and may have been distributed from island to island as stowaways in the great sailing canoes of the Polynesians, even to such remote points as Ocean Island. Their spread by this means is as logical as the known spread of the gray rat by means of the sailing ships of the Caucasian.

The largest county on earth.

Dwellers in some of our western states speak in bragging terms of the size of certain counties within their domain, but their expanses of desert appear insignificant when we learn that Johnston Island, seven hundred miles southwest of Oahu is included casually in Honolulu County. Johnston Island is seldom visited. Sampan fishermen from Honolulu at times come here but more often are unable to locate the island as adverse currents frequently throw them from their course, and aside from the fishing there is little there to attract casual visitors.

We ^{came to} sighted the island one forenoon in July, locating it first by ^a the greenish shimmer of reflected light from the lagoon in the sky, and finally sighting the land as a yellowish haze that ^{at length} finally was resolved into a low island with a small hill on one end, the whole covered with clumps of grass and other plants. Landings here are made easily only at high tide, as when the tide ebbs extensive flats of limestone and coral that effectually block the passage of boats are exposed off shore.

The main island has a loose sandy soil overlying a slightly elevated ledge of limestone. A mile east lies a smaller bit of land known as Sand Island, and beyond are extensive flats of coral and limestone, as was determined by a naval hydroplane brought along with our ship to make photographic maps of the islands and the surrounding reefs.

These islands form a connecting link between the Hawaiian Islands and Palmyra, Fanning, and other groups to the south near the Equator. It seemed distinctly warmer than farther north and those engaged in studying the marine life found in the surrounding waters an interesting blending of northern and southern groups.

It was fascinating indeed to go out over the outer reefs at night with a water glass (a box or pail with a glass bottom that, thrust in the water, gives vision unclouded by reflection or ripples), and a flashlight. Broad flats covered with a few inches of water are filled with six or eight species of corals of variety of shape and form. Deeper openings four or five feet across form natural aquaria for a multitude of fishes, many of odd form and the majority beautiful with almost unbelievable brilliancy of color. Strange eels lurk beneath coral ledges and everywhere sprawl huge repulsively black sea-cucumbers (holothurians) a foot long and two or three inches in diameter. At low tide one may walk for long distances along the exposed masses of coral with waves breaking a short distance away. Large handsome shells and multitudes of sea-urchins covered with spines are revealed in the dancing beam of light and occasionally the eyes of a spiny lobster shine out like diamonds. These, ^{last} a delicacy in the market, were so abundant on some of our islands that enough were secured ^{at one time} to feed our shore party and the ship's company of sixty men.

The moan of shearwaters and the shrill calls of terns on the island a mile away mingle in a subdued monotone, the air is cool and the water warm. We meditate on the strange creatures about us and finally mindful of long hours of work on the morrow begin the return to camp.

The end.

Such then is the life and a hint of a history of our remoter possessions in Hawaii. Some may contend that the birds found here represent potential injury to important fishing industries, but on examination we find such statements wholly without basis as shearwaters, albatross, and related forms feed mainly on squid and the fish-eating boobies prey largely on flying fishes, of no great value. On the other hand in the past these same birds have built up great guano deposits exploited for tremendous profits and further deposits of like nature are developing slowly today.

To the ignorant the islands that we have visited may seem worthless but we may rejoice that they are held in a reservation under wise governmental supervision that may insure continuance for diverse creatures of interesting form and habit, harmless in their contact with man, and aside from their aesthetic appeal of decided value as a certain food supply to the unfortunate who may chance to be castaway on these inhospitable shores.